

Application Number: 10/821,769
Amendment Dated: October 27, 2005
Reply to Office Action Dated: July 27, 2005

Listing of the Claims:

1. (currently amended) A fiber-reinforced composite spring comprising:
a spring wire comprising:
a core that includes a plurality of fiber tows ~~twisted about a longitudinal axis to create a contoured core surface; and~~
an outer layer of resin that is substantially devoid of said the fiber tows, wherein said the resin outer layer ~~being formed by twisting said core to remove a portion of said resin from said core, having that varies along the longitudinal axis to form a generally uniform outer surface about the core and having a cross section having a substantially constant diameter whereby~~ has a constant thickness and cross-sectional shape, and is generally uniform and free of any surface irregularities, thereby yielding a the spring that has a predictable rate of deformation when subjected to a compressive load.
2. (original) The spring of claim 1, wherein the core is disposed within the spring wire at a generally central location.
3. (cancelled)
4. (currently amended) The spring of claim 1, wherein said the spring has a generally circular ~~cross-section~~ cross-sectional shape.
5. (original) The spring of claim 4, wherein the core is generally concentric with the generally uniform outer surface such that the core is located at a substantially constant radial distance from the generally uniform outer surface for a cross-section of the spring wire taken at a point along the longitudinal axis.
6. (cancelled)

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7. (currently amended) The spring of claim 1, wherein the core has a rectangular-cross sectional shape and the core has a the central axis that is generally coaxial with a central axis of the spring wire such that the central axis of the core is located at an approximately equal radial distance from opposing planar surfaces of the rectangular cross-section of the generally uniform outer surface of the rectangular-shaped core.

8. (currently amended) The spring of claim 1, wherein ~~said~~ the fiber tows are natural fibers selected from the group consisting of jute and rayon fibers.

9. (currently amended) The spring of claim 1, wherein ~~said~~ the fiber tows are synthetic fibers selected from the group consisting of glass, carbon, boron, boron, silicon carbide, aluminum oxide, quartz, alumina-silica, alumina-boria-silica, zirconia-silica, and fused silica fibers.

10. (currently amended) The spring of claim 1, wherein ~~said~~ the resin is a thermoplastic resin.

11. (currently amended) The spring of claim 1, wherein ~~said~~ the resin is a thermosetting resin selected from the group consisting of epoxy, bis-maleimide, polyimide, polyester, vinyl ester resins, polyether, ether ketone, polyphenylene sulfide, polyetherimide, and polyamide imide resins.

12. (currently amended) A fiber-reinforced composite spring formed by a process comprising the steps of:
impregnating a plurality of fiber tows with a resin to form a core;
encasing at least a portion of ~~said~~ the core within a cavity having desired interior dimensions;

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forming an outer resin layer on said the core by removing a portion of said the resin from said the impregnated fiber tows by twisting said the core within the cavity to form a spring wire ~~having a cross section having a substantially constant diameter where~~ the resin outer layer has a constant thickness and cross-sectional shape, and is generally uniform and free of any surface irregularities, and whereby the spring has a predictable rate of deformation when subjected to a compressive load; and
shaping said the spring wire to form a spring.

13. (currently amended) The spring of claim 12, wherein said the step of encasing at least a portion of said the core within said the cavity comprises the steps of:
providing a generally planar sheet of flexible shroud material;
placing said the core in contact with said the sheet of shroud material;
wrapping said the sheet of shroud material around said the core; and
securing a first portion of said the sheet of shroud material to a second portion of said the sheet of shroud material to form said the cavity around the core.

14. (currently amended) The spring of claim 12, wherein said the step of impregnating said the plurality of fiber tows with said the resin comprises the step of:
impregnating said the plurality of fiber tows with a thermoplastic resin.

15. (currently amended) The spring of claim 14, wherein the step of encasing at least a portion of said the core within said the cavity comprises the steps of:
at least partially solidifying said the thermoplastic resin to minimize smearing of said the resin while encasing said the core;
inserting said the core and said the at least partially solidified thermoplastic resin into said the cavity; and

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exposing ~~said~~ the thermoplastic resin within ~~said~~ the cavity to a suitable source of energy for liquefying ~~said~~ the at least partially solidified thermoplastic resin within ~~said~~ the cavity.

16. (currently amended) The spring of claim 15, wherein ~~said~~ the cavity is an interior passage defined by a shroud of flexible material that is to encase ~~said~~ the spring wire.

17. (currently amended) The spring of claim 12, wherein ~~said~~ the process further comprises the steps of:

at least partially solidifying ~~said~~ the resin in the spring shape within ~~said~~ the cavity; and

removing ~~said~~ the spring wire from ~~said~~ the cavity.

18. (currently amended) The spring of claim 17, wherein ~~said~~ the resin is a thermosetting resin.

19. (currently amended) The spring of claim 18, wherein ~~said~~ the step of at least partially solidifying ~~said~~ the resin within ~~said~~ the cavity includes the steps of:

wrapping ~~said~~ the spring wire around a mandrel; and

at least initiating crosslinking of the thermosetting resin.

20. (currently amended) The spring of claim 12, wherein the step of shaping ~~said~~ the spring wire to form ~~said~~ the spring comprises wrapping ~~said~~ the spring wire encased within ~~said~~ the cavity around a mandrel.

21. (cancelled)

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22. (cancelled)

23. (cancelled)

24. (cancelled)

25. (cancelled)

26. (cancelled)

27. (cancelled)

28. (cancelled)

29. (cancelled)

30. (cancelled)